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$MgSiO_3$ ポストブリッジマナイト相の高温高圧状態方程式
Thermal equations of state of $MgSiO_3$ post-bridgmanite phase

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$MgSiO_3$ post-bridgmanite phase exists at the lowermost mantle of the Earth. Thus many studies on the equation of state of the phase were done at the lowermost mantle P-T conditions (Caracas and Cohen, 2008; Guignot et al., 2007; Oganov and Ono, 2004; Ono et al., 2006; Tsuchiya et al., 2004; Mosenfelder et al., 2009). On the other hand, super-Earths which have a few times of the Earth's mass have been found in the extra solar system one after another. $MgSiO_3$ post-bridgmanite is an abundant silicate phase in such huge terrestrial planet's mantle (Tsuchiya and Tsuchiya, 2011). Although the pressure condition of super-Earth's mantle reaches several hundred GPa, previously reported EoSs of post-bridgmanite by the laser heated diamond anvil cell (LHDAC) experiment were limited up to around 150 GPa. Moreover, the post-bridgmanite is expected to exist in Uranus's and Neptune's rocky cores and also early Earth's proto-core. The direct determination of the compression behavior of post-bridgmanite at multi-megabar pressure is, therefore, important to understand the super-Earth's interior and so on.

Here we report PPv EoSs up to 258 GPa and 2140 K based on the LHDAC experiment and up to 1 TPa and 6000 K by ab initio calculation based on the density-functional theory in the same manner as Tsuchiya et al. (2004). The experimental EoS agrees excellently with the calculated ab initio volume data within 1% up to 400 GPa and 6000 K. The volume differences between the present result and the EoS based on shock experiment data (Mosenfelder et al. 2009) was also 1% at 400 GPa and 300 K. The present EoSs show internal consistency among LHDAC, shock and ab initio data up to 400 GPa within 1% in volume. Our new EoSs are applicable to not only the Earth's core-mantle boundary region but also the super-Earth's mantle and early Earth's proto core.

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